

### REMARKS

This preliminary amendment is directed to the above-referenced application on which a Request for Continued Examination (RCE) was filed on May 19, 2003.

Claims 2, 4-5, 7 and 14-17 are pending. Claims 2, 4, 14, 15 and 17 are amended, and new claims 18 and 19 are added herein.

Claims 2, 4, 15 and 17 are independent.

Claims 2 and 14-17 stand rejected under 35 USC §102(b), as anticipated by Tucker et al. (U.S. Patent No. 4,929,423). Claims 4-5 and 7 stand rejected under 35 USC §103(a), as obvious over Kenji et al. (JP Pub. 11-021660), in view of Tucker. The rejections are respectfully traversed.

The traversal arguments presented in the remarks submitted with the Amendments filed on September 9, 2002 and March 19, 2003, and in the Request for Reconsideration filed concurrently with the filing of the above referenced RCE on May 19, 2003, are reasserted herein in their entirety. As detailed in these prior responses, the claims, as pending prior to the present amendment, patentably distinguish over the applied prior art. Accordingly, the present amendments are not made for purposes of patentability, but rather to delete unnecessary limitations, to refocus certain claims, and for purposes of clarification. New claim 18, which depends from claim 2, is added to recite features deleted from its parent claim, and new claim 19, which depends from claim 15, is added to recite features deleted from its parent claim.

An objective of the present invention is to provide a lead-free solder for a connection lead that gives enhanced connection strength. Accordingly, the preamble of independent claims 2, 15 and 17 is amended to require a lead-free solder used to

connect a connection lead to a material. Independent claim 4 remains directed to a connection lead.

Tucker, on the other hand, relates to a plumbing solder (see column 1, line 7), not to a solder for connection lead as claimed in the present application. Tucker is not concerned with, and accordingly lacks any disclosure relating to, the enhancement of lead connection strength. Instead, Tucker is only concerned with properties relevant to plumbing solder, such as those which affect shear stress, tensile strength, corrosion etc. (see Tucker's Examples 1-3).

Thus, the objectives of Tucker and the present invention are entirely and clearly different.

To achieve the above referenced objective, the present invention requires that the lead free solder have a predetermined amount of phosphorus and exclude bismuth.

Thus, independent claim 2 requires a lead-free solder having an alloy composition which includes 0.002 to 0.015% by mass of phosphorus with the balance consisting of tin, and excludes bismuth; independent claim 4 requires, in part, plating which is formed of a lead-free solder composed mainly of tin, and which contains 0.002 to 0.015% by mass of phosphorus with the balance consisting of tin and excluding bismuth; independent claim 15 requires an alloy composition which includes, *inter alia*, 0.002 to 0.015% by mass of phosphorus, but excludes bismuth, and is for a lead free solder; and independent claim 17 requires an alloy composition for a lead free solder which consists essentially of 0.002 to 0.015% by mass of phosphorus, 2.0 to 5.0% by mass of silver, 0.01 to 2.0% by mass of copper, and tin.

In summary, as amended herein, each of the independent claims requires either an alloy composition for a lead free solder or a plating formed of lead free solder, which essentially excludes bismuth and includes 0.002 to 0.015% by mass of phosphorus, and which can be used for a connection lead.

It is respectfully submitted that Tucker lacks any disclosure of an alloy composition or plating as recited in each of the independent claims i.e., an alloy composition or plating that includes a predetermined amount of phosphorus and excludes bismuth. Because the required amount of phosphorus and the exclusion of bismuth are indispensable for achieving the above referenced objective of the invention, i.e., the enhancement of the lead connection strength, Tucker is incapable of meeting this objective. That is, Tucker does not disclose an alloy composition that is capable of achieving the enhancement of the lead connection strength achievable with the present invention. Indeed, since Tucker is only concerned with plumbing solder, those skilled in the art would have no motivation to even attempt to modify the compositions disclosed by Tucker for plumbing solder, to achieve an enhancement in the lead connection strength.

The following table presents, in part, the information set forth in Tables 1 and 2 of Tucker, and further highlights the differences between the present invention and the solder compositions disclosed in Tucker (particularly in regards to Bi, P and Pb):

Solder No.	Bismuth	Phosphorus	Lead
1	8.0	None	None
2	10.7	None	None
3	3.8	None	None
4	6.0	None	None

5	None	None	30
6	None	None	50
7	3.8	None	None
8	10.8	None	None
9	3.8	0.01	None

As shown above, Tucker lacks any disclosure of a solder composition which is lead and bismuth free, but includes phosphorus, as claimed in the present application. Thus, the invention, as claimed herein, is both novel and unobvious, and therefore patentable over the applied art.

Furthermore, with regard to Tucker's description in column 1, lines 21-26, which relates to prior art relevant to the Tucker invention, Tucker discloses that the EP-0251611 reference had previously proposed a composition which is essentially free of both lead and bismuth. However, there is nothing in Tucker's description to suggest that the composition proposed in EP-0251611 includes phosphorus as claimed herein.

Moreover, EP-0251611 is directed to a low toxicity soldering composition (see Tucker at column 1, line 21), which is a primary concern in plumbing solders. Hence, like Tucker, the EP-0251611 reference has no reason to be concerned with enhancing lead connection strength.

Further still, since the present invention relates to lead connections, toxicity is not a substantial concern. Electronic devices frequently employ toxic material, e.g., GaAs. Therefore, there is nothing in the prior art relating to lead connections to motivate the exclusion of bismuth, since lead connections are commonly used in electronic devices. Hence, one skilled in the art of lead connections would find nothing in either Tucker or EP-0251611 to motivate a modification of known lead connections compositions to

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exclude bismuth.

Finally, Kenji does not cure the defects in Tucker or EP-0251611. Indeed, the Examiner acknowledges that Kenji lacks the phosphorus required in each of the independent claims.

In view of the foregoing, it is respectfully submitted that the application is in condition for allowance and an early indication of the same is courteously solicited. The Examiner is respectfully requested to contact the undersigned by telephone at the below listed local telephone number, in order to expedite resolution of any remaining issues and further to expedite passage of the application to issue, if any further comments, questions or suggestions arise in connection with the application.

To the extent necessary, a petition for an extension of time under 37 C.F.R. 1.136 is hereby made. Please charge any shortage in fees due in connection with the filing of this paper, including extension of time fees, to Deposit Account 01-2135 and please credit any excess fees to such deposit account.

Respectfully submitted,  
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**AMENDMENTS TO CLAIMS**  
**(DELETIONS IN BRACKETS AND ADDITIONS UNDERLINED)**

**IN THE CLAIMS**

Please amend the claims as follows:

2. (Three Times Amended) [The] A lead-free solder used to connect a connection lead to a material, comprising:

an alloy composition containing [2.0 to 5.0% by mass of silver, 0.01 to 2.0% by mass of copper, and] 0.002 to 0.015% by mass of phosphorus with the balance consisting of tin, wherein said alloy composition excludes bismuth.

4. (Twice Amended) A connection lead comprising:

a copper strip or other strip conductor; and

a plating provided on at least one side of the strip constructor, said plating being formed of a lead-free solder composed mainly of tin,

said plating containing 0.002 to 0.015% by mass of phosphorus[, 2.0 to 5.0% by mass of silver, 0.01 to 2.0% by mass of copper,] with the balance consisting of tin and excluding bismuth, and having a shape such that the plating in a widthwise direction of the strip conductor has a bulge as viewed in section with an apex being located at a proper position in the widthwise direction of the strip conductor.

14. (Amended) The lead free solder according to claim 2, wherein:

the alloy composition [excludes bismuth] further containing 2.0 to 5.0% by mass of silver and 0.01 to 2.0% by mass of copper.

15. (Amended) An alloy composition for a lead free solder used to connect a connection lead to a material, comprising:

0.002 to 0.015% by mass of phosphorus;

[2.0 to 5.0% by mass of silver;  
0.01 to 2.0% by mass of copper;] and  
tin, wherein said alloy composition excludes bismuth.

17. (Amended) An alloy composition for a lead free solder used to connect a connection lead to a material, consisting essentially of:

0.002 to 0.015% by mass of phosphorus;  
2.0 to 5.0% by mass of silver;  
0.01 to 2.0% by mass of copper; and  
tin.